

### **Remarks**

This Reply is submitted in response to the Office Action mailed July 13, 2005 wherein Claims 17-18, 21-22, 24-28, 31-32, 34-35, 38-42, 45, 63-64, 67-68, 70-74, 77-78, 80-81, 84-88, and 91 were rejected as being unpatentable over a CLEO Presentation by Goers et al. ("Goers") in view of U.S. Patent Application No. 2004/0006276 to Demos et al. ("Demos"); Claims 19, 36, 65, and 82 were rejected as being unpatentable over Goers in view of Demos and further in view of U.S. Patent No. 6,304,237 to Karakawa ("Karakawa"); Claims 20, 23, 37, 66, 69, and 83 were rejected as being unpatentable over Goers in view of Demos and further in view of U.S. Patent Application No. 2003/0081192 to Nishi ("Nishi"); Claims 29-30, 43-44, 75-76, and 89-90 were rejected as being unpatentable over Goers in view of Demos and further in view of U.S. Patent No. 6,751,010 to Richter ("Richter"); and Claims 46 and 92 were rejected as being unpatentable over Goers in view of U.S. Patent Application No. 2004/0036957 to Galvanauskas et al ("Galvanauskas"). The Office Action also indicated that Claims 33 and 79 were objected as being dependent on a rejected base claim, being allowable if rewritten in independent form, and Claim 1-16 and 47-62 were allowed.

In response, Applicants traverse the rejection of Claims 17-32, 34-46, 63-78, and 79-92 for the reasons provided below. **Claims 1-92 are thus pending in the application.**

For the reasons set forth below, Applicants respectfully submit that all remaining claims in this application are patentably distinct over the prior art of record. Reconsideration and allowance of all pending claims in the application are respectfully solicited.

### **REJECTION TO THE CLAIMS**

#### **Rejection under 35 U.S.C. §103(a)**

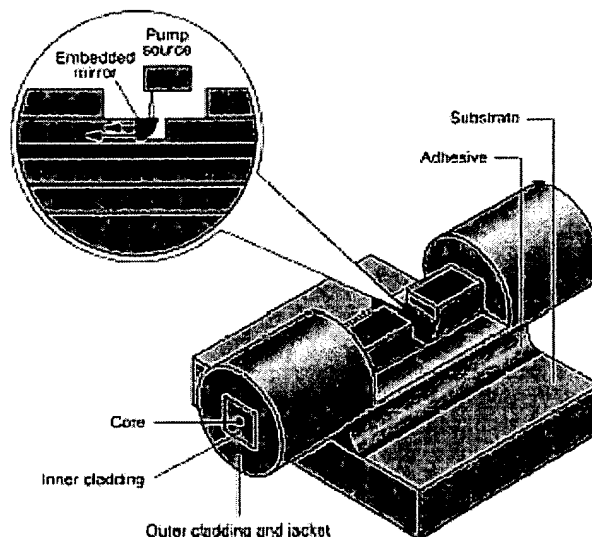
Claims 17-18, 21-22, 24-28, 31-32, 63-64, 67-68, 70-74, and 77-78 were rejected as being unpatentable over Goers in view of Demos. Applicant respectfully traverses this rejection as Goers and Demos, either alone or in combination, do not render the claims unpatentable for the reasons presented below.

The independent claims of each rejected claim (Claims 17 and 63) recite, in part, a light-generating device producing light at more than one wavelength, an optical fiber amplifier having a Yb-doped, tapered optical fiber, to accept light from the light-generating device, and a

nonlinear frequency converter to accept the amplified light and shift the amplified light's wavelength.

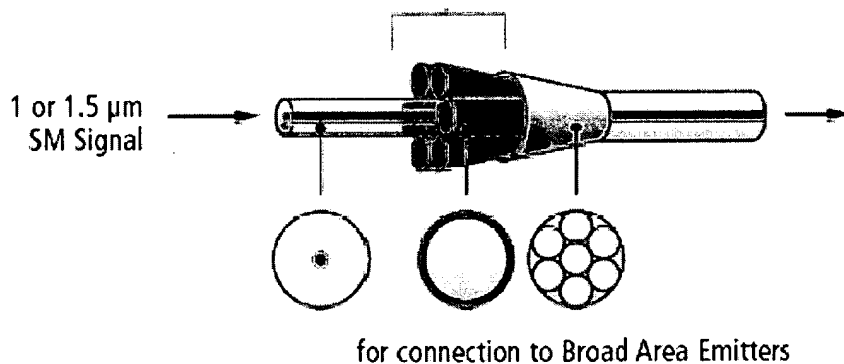
Goers teaches a light source used in a Backscatter Absorption Gas Imaging (BAGI) system. The light source of Goers combines a seed module, a fiber amplifier, and a nonlinear frequency converter to produce light at specific and tunable wavelengths. Specifically, the seed module and amplifier work in combination to provide light at a single wavelength (1064 nm) to an optical parametric oscillator (OPO) module of the nonlinear frequency converter, which uses non-linear optics to shift the wavelength of amplifier light to a wavelength useful for BAGI (paragraph 4, lines 3-4).

Goers further teaches a fiber amplifier that is pumped by providing light into "two V-grooves with 100- $\mu$ m-stripe diodes" (paragraph 4, line 2). As is known in the art, the V-groove amplifier of Goers includes a mirror formed on a notch in the outer coating of an optical fiber that is side pumped. The following diagram, which was obtained from the Internet at <http://www.nrl.navy.mil/techtransfer/pdfs/OP103.pdf>, illustrates one V-groove pumping configuration.



Demos teaches an illumination assembly for mechanically scanning light. The light sources of Demos include one or more monochromatic CW light sources, such as broadband, filtered sources. Switching means are used to select the output from a selected one of the monochromatic sources, which is then delivered to the inside of the human body.

One of the three criteria which must be met to establish a *prima facie* case of obviousness (MPEP §2142) is that the references must teach or suggest all claim limitations. First, each of the rejected claims includes, through its dependency, the recitation of a tapered optical fiber amplifier. Applicants can find no teaching or suggestion in the cited references of a tapered fiber amplifier. Specifically, Applicants can find no teaching in Demos of laser amplifiers. Goers teaches a V-groove amplifier, as discussed above, but this is different than a tapered fiber amplifier. One example of the claimed tapered fiber amplifier is illustrated in the following figure, which was obtained from the Internet at <http://www.specialtyphotonics.com/pdf/products/specialty/highpower/SM%20PowerMAX%20Combiners.pdf>. Tapered fiber amplifiers accept light in a fiber and a plurality of pump beams in fibers that converge in a fused, tapered region.



Second, each of the rejected claims includes, through its dependency, the recitation of a light-generating device producing light at more than one wavelength, and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. In other words, the light from the light-generating device having more than one wavelength is provided to the amplifier. Applicants can find no teaching in the cited references of a light-generating device producing light of more than one wavelength that is then amplified. In addition, Applicants respectfully submit that the combination suggested in the rejection does not form the claimed invention. Demos teaches a device for sequentially selecting one of a number of wavelengths. Replacing the seed module of Goers with the device of Demos results in a device that sequentially amplifies one of a number of wavelengths, and not a device that amplifies light that is more than one wavelength. As such, the combination thus does not result in the claimed invention. (The motivation for this recitation, which is not found in any of

the cited references, is to increase the output of the optical parametric amplifier, see paragraphs [0071] and [0074], and is not found in the cited references).

Another criteria necessary to establish a *prima facie* case of obviousness is some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings to obtain the claimed invention. Regarding the type of amplifier, Applicants can find no suggestion or motivation within the cited references to replace the V-groove amplifier with a tapered fiber amplifier.

Applicant also finds no motivation to combine as stated in the rejection. Goers and Demos both teach a complete light source for remote sensing. The combination implied in the rejection replaces a part of the light source of Goers, the “seed module,” with the light source of Demos. There is no motivation with Goers to modify Goers’ BAGI system in such a manner since Goers teaches a light source that spans the required wavelength range without any change in wavelength of the seed module. (Goers “spans the absorption range of methane as well as most volatile species encountered in refineries” (paragraph 3).

In summary, Applicants cannot find each limitation in the cited references, specifically a tapered fiber amplifier or a light-generating device producing light at more than one wavelength with an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. In addition Applicants cannot find a motivation to combine the references, and further submit that the references, if combined do not form the claimed invention. For any one of these reasons a *prima facie* case of obviousness has not been established, and it is respectfully requested that the Examiner withdraw the rejection of Claims 17 and 63 under 35 U.S.C. §103(a). It is also respectfully requested that the Examiner withdraw the rejection under 35 U.S.C. §103(a) of Claims 18, 21-22, 24-28, and 31-32, which depend on Claim 17, and on Claims 64, 67-68, 70-74, and 77-78, which depend on Claim 63 under 35 U.S.C. §103(a).

Further, with respect to claims 32 and 78, the Examiner has stated that “it is inherent that at least one pump laser is an air cooled pump laser having an operating temperature at an ambient.” Applicants can find no teaching or suggestion in the cited references of an air cooled pump laser, and can find no suggestion of modifying the references to provide an air cooled

pump laser. Applicants respectfully suggest that Examiner's assertion of inherency is an inadmissible application of hindsight.

For this reason a *prima facie* case of obviousness has not been established and it is also requested that the Examiner withdraw the rejection of Claims 32 and 78 under 35 U.S.C. §103(a).

Claims 19, 36, 65, and 82

Claims 19, 36, 65, and 82 were rejected as being unpatentable over Goers in view of Demos and further in view of Karakawa. Applicant respectfully traverses this rejection as Goers, Demos, and Karakawa, either alone or in combination, do not render the claims unpatentable for the reasons below.

Goers and Demos are described above. Karakawa teaches a light source that simultaneously produces light at three different wavelengths for an R, G, B display with a repetition rate greater than 40 kHz. Karakawa is silent as to the details of any amplifier, or of using an optical amplifier to pump more than one wavelength.

The reasons for patentability will now be presented separately for Claims 19 and 65 and for Claims 65 and 82.

*Claims 19 and 65*

Claims 19 and 65 depend on Claims 17 and 63, respectively. The rejection states that Goers in view of Demos discloses all limitations except for the quasi-continuous-light recitation. Applicants respectfully disagree.

Applicant cannot find any teaching or motivation in Karakawa regarding the following recited elements of Claims 17 and 63: a tapered fiber amplifier; or a light-generating device producing light at more than one wavelength, and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. For this reason and the reasons presented above regarding of Claims 17 and 83, Applicants can find no teaching or suggestion in any combination of Goers, Demos, and Karakawa of either: a tapered fiber amplifier; or a light-generating device producing light at more than one wavelength and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. Further, Applicants cannot find a motivation to

combine the references, and submit that the references, if combined do not form the claimed invention.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 19, which depends on Claim 17, and Claim 65, which depends on Claim 33. For this reason, it is also requested that the Examiner withdraw the rejection of Claims 19 and 65 under 35 U.S.C. §103(a).

*Claims 36 and 82*

Claim 36, through its dependency on Claim 34, and Claim 82, through its dependency on Claim 80, each recite two or more light-generating devices each producing light at more than one wavelength and a switch to select light from one of said two or more light-generating devices. The rejection states that Goers in view of Demos discloses all limitations except for the quasi-continuous-light recitation. Applicants respectfully disagree.

Applicant cannot find any teaching or motivation in either Kawakawa, Goers, or Demos regarding the following recited element of independent Claims 34 and 80: two or more light-generating devices each producing light at more than one wavelength and a switch to select light from one of said two or more light-generating devices and an optical fiber amplifier to accept said selected light and produce amplified light at the more than one wavelength of said selected light. Thus, for example, Karakawa teaches a light source that produces three separate wavelengths from one light source, Goers teaches a system that amplifies a single wavelength, and Demos switches between a plurality of monochromatic light sources. None of these references teaches or suggests switching a light-generating device that generates more than one wavelength, or teaches or suggests amplifying more than one wavelength at a time. In addition, there is no motivation within the references to provide a light source that is switchable between light sources having more than one wavelength.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claim 36, which depends on Claim 34 and Claim 82, which depends on Claim 80. For this reason, it is also requested that the Examiner withdraw the rejection of Claims 36 and 82 under 35 U.S.C. §103(a).

Claims 20, 23, 37, 66, 69, and 83

Claims 20, 23, 37, 66, 69, and 83 were rejected as being unpatentable over Goers in view of Demos and further in view of Nishi. Applicant respectfully traverses this rejection as Goers, Demos, and Nishi, either alone or in combination, do not render the claims unpatentable for the reasons below.

Goers and Demos are discussed above. Nishi teaches an exposure apparatus for photolithograph in the range of less than 200 nm for use in photolithography. Nishi is directed to the problem of providing a light source that operates at a specific, narrow bandwidth and spatial coherence (paragraph [0017], next to last sentence).

The reasons for patentability will now be presented separately for Claims 20, 23, 66, and 69 and for Claims 37 and 83.

*Claims 20, 23, 66, and 69*

Claim 20 and 23 depend on Claim 17, and Claims 66 and 69 depend on Claim 63. The rejection implies that Goers in view of Demos discloses all limitations in Claims 17 and 63, except for the type of light-generating device. Applicants respectfully disagree.

Applicants can find no teaching or suggestion in Nishi regarding a light-generating device producing light at more than one wavelength and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. As discussed above, Applicant cannot find any teaching or motivation in either Goers or Demos regarding a light-generating device producing light at more than one wavelength and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength.

For this reason and the reasons presented above, Applicants can find no teaching or suggestion in any combination of Goers, Demos, and Nishi of a light-generating device producing light at more than one wavelength and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength of Claims 17 or 63, cannot find a motivation to combine the references, and submit that the references, if combined do not form the claimed invention. For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 20, 23, which depend

on Claim 17, and Claims 66 and 69, which depend on Claim 63. For this reason, it is requested that the Examiner withdraw the rejection of Claims 20, 23, 66, and 69 under 35 U.S.C. §103(a).

*Claims 37 and 83*

Claim 37 depends on Claim 34, and Claim 83 depends on Claim 80. The rejection implies that Goers in view of Demos discloses all limitations in Claims 34 and 80, except for the type of light-generating device. Applicants respectfully disagree.

Applicant cannot find any teaching or motivation in either Nishi, Goers, or Demos regarding the following recited element of Claims 34 and 80: two or more light-generating devices each producing light at more than one wavelength and a switch to select light from one of said two or more light-generating devices and an optical fiber amplifier to accept said selected light and produce amplified light at the more than one wavelength of said selected light. Thus, for example, Nishi teaches a light source that produces light of a single wavelength, Goers teaches a system that amplifies a single wavelength, and Demos switches between a plurality of monochromatic light sources. None of these references teaches or suggests switching a light-generating device that generates more than one wavelength, or teaches or suggests amplifying more than one wavelength at a time. In addition, there is no motivation within the references to provide a light source that is switchable between light sources having more than one wavelength.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 37, which depends on Claim 34, and Claim 83, which depends on Claim 80. For this reason, it is requested that the Examiner withdraw the rejection of Claims 37 and 83 under 35 U.S.C. §103(a).

Claims 29-30, 43-44, 75-76, and 89-90

Claims 29-30, 43-44, 75-76, and 89-90 were rejected as being unpatentable over Goers in view of Demos and further in view of Richter. The rejection states that Goers in view of Demos discloses all limitations except the singly and doubly resonant OPOs. Applicant respectfully traverses this rejection as Goers, Demos, and Richter, either alone or in combination, do not render the claims unpatentable for the reasons below.

Goers and Demos are discussed above. Richter teaches a low-finesse optical parametric oscillator. The optical parametric oscillator of Richter is pumped with a narrow-linewidth laser.



The reasons for patentability will now be presented separately for Claims 29-30 and 75-76, and for Claims 43-44 and 89-90.

*Claims 29-30 and 75-76*

Claims 29-30 depend on Claim 17, and Claims 75-76 depend on Claim 63. Applicant cannot find any teaching or motivation in Richter regarding the following recited elements of Claims 17 and 63: a tapered fiber amplifier; or a light-generating device producing light at more than one wavelength and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength. For this reason and the reasons presented above, Applicants can find no teaching or suggestion in any combination of Goers, Demos, and Richter of either a tapered fiber amplifier or a light-generating device producing light at more than one wavelength, and an optical fiber amplifier to accept light from said light-generating device and produce amplified light at said more than one wavelength, cannot find a motivation to combine the references, and submit that the references, if combined do not form the claimed invention.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 29-30, which depend on Claim 17, and Claims 75-76, which depend on Claim 63. For this reason, it is also requested that the Examiner withdraw the rejection of Claims 29-30 and 75-76 under 35 U.S.C. §103(a).

*Claims 43-44 and 89-90*

Claims 43-44 depend on Claim 34, and Claims 89-90 depend on Claim 80. The rejection implies that Goers in view of Demos discloses all limitations in Claims 34 and 80, except for the type of light-generating device. Applicants respectfully disagree.

Applicant cannot find any teaching or motivation in either Richter, Goers, or Demos regarding the following recited element of Claims 34 and 80: two or more light-generating devices each producing light at more than one wavelength and a switch to select light from one of said two or more light-generating devices and an optical fiber amplifier to accept said selected light and produce amplified light at the more than one wavelength of said selected light. Thus, for example, Richter teaches a light source that produces light of a single, tunable wavelength, Goers teaches a system that amplifies a single wavelength, and Demos switches between a

plurality of monochromatic light sources. None of these references teaches or suggests switching a light-generating device that generates more than one wavelength, or teaches or suggests amplifying more than one wavelength at a time. In addition, there is no motivation within the references to provide a light source that is switchable between light sources having more than one wavelength.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 43-44, which depend on Claim 34, and Claims 89-90, which depend on Claim 80. For this reason, it is requested that the Examiner withdraw the rejection of Claims 43-44, and 89-90 under 35 U.S.C. §103(a).

Claim 46 and 92

Claim 46 and 92 were rejected as being unpatentable over Goers in view of Galvanauskas. Applicant respectfully traverses this rejection as Goers and Galvanauskas, either alone or in combination, do not render the claims unpatentable for the reasons below.

Claims 46 and 92 both recite, in part, a light source comprising a diode-pumped fiber laser producing an output of light at more than one wavelength, where said diode-pumped fiber laser is an air-cooled laser having an operating temperature at an ambient temperature, and where said output varies with temperature, and a nonlinear frequency converter including an OPO to accept said output and generate an output of the light source at wavelengths shifted from and corresponding to each of said more than one wavelength.

Applicant respectfully submits that the references do not teach or suggest each claim limitation. In particular, the rejection states, in part, that Goers discloses: a diode-pumped fiber laser producing an output of light at more than one wavelength; an air-cooled, diode-pumped laser; an OPO to shift more than one wavelength. Applicant disagrees. As noted above, Goers teaches a seed module that pumps a fiber amplifier at a single wavelength (1064 nm), and an OPO that produces a single frequency idler output (paragraph 4). In addition, Goers is silent as to whether the diode-pumped laser is air-cooled or not. The Examiner's assertion of an air-cooled laser is not supported by the facts.

For any of these reasons, a *prima facie* case of obviousness has not been established with respect to Claims 46 and 92. For this reason, it is also requested that the Examiner withdraw the rejection of Claims 46 and 92 under 35 U.S.C. §103(a).

**ALLOWABLE SUBJECT MATTER**

Applicants acknowledge the Examiner's indication that Claim 1-16 and 47-62 have been allowed. Applicant gratefully acknowledges the Examiner's allowance of these claims.


Applicants also acknowledge the indication that Claims 33 and 79 would be allowable if presented in independent form to include the limitations of their respective base claims and any intervening claim. Applicants thank the Examiner for this indication of allowance, and wish to consider the Examiner's response to this Amendment before taking action on it.

Applicants respectfully submit that the application is in condition for allowance and action to that end is respectfully solicited. If the Examiner should feel that a telephone interview would be productive in resolving any issues in the case, please telephone the undersigned at the number listed below.

Respectfully submitted,

November 12, 2005

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